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SANITARY LANDFILL VERSUS INCINERATION

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Sanitary Landfill versus Incineration*

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Municipal refuse disposal is one of the more important public health problems of the day. Lest there be misunderstanding of this topic, "Sanitary Landfill versus Incineration," let me point out at the outset that both are acceptable sanitary methods of disposing of refuse.

Where insanitary practices are followed, the possibilities for disease transmission are obviously heightened. Insanitary practices also give rise to various nuisances that are objectionable to people who are subjected to them.

Open dumps are breeders of flies and rats, both of which may be agents in disease transmission. Flies are well known for their filthy habits, which lead to the transmission of various enteric diseases such as dysentery, diarrhea, etc. Rats find open dumps ideal habitats in which to breed, feed, and thrive. They are of public health importance primarily for their role as host to the flea that transmits murine typhus fever. Furthermore, open dumps for garbage and rubbish are obnoxious because of the smoke and odor associated with them, as well as the unsightly appearance of the dumping area. Nearby streams may also be polluted by dumps.

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Hog-feeding with garbage is widely practiced throughout most of the United States. It is generally regarded by authorities as the primary factor in the high incidence of trichinosis. Studies conducted over several years by the National Institutes of Health indicate that one in every six persons in the United States has some trichina infection.(1) It is estimated that of those infected, 4.2 per cent, or approximately one million people, had infections sufficiently heavy to cause clinical symptoms of the disease at sometime during their life. In the matter of diagnosis, unfortunately, these symptoms are so easily confused with those of many other diseases that trichinosis is rarely recognized except in occasional outbreaks which can be directly associated with the consumption of insufficiently cooked pork or pork products. Hog-feeding farms where raw garbage is used are also generally obnoxious because of offensive odors, unsightliness, flies, and rodents.

Some other methods of refuse disposal have objectionable features, but are of less direct importance from the public health viewpoint. The practice of hauling refuse to sea and dumping from scows creates problems in regard to off-shore fishing and nearby bathing beaches. Municipal grinding of garbage which is discharged into rivers causes obnoxious down-stream conditions.

The practices of municipalities for collecting and disposing of refuse vary widely, and, by and large, are subject to much criticism in comparison with other sanitation standards of the Nation.

With few exceptions, local public health agencies have shown little interest in the problem, leaving it to other departments of the community or to the citizens themselves.

The reluctance, or inability, of public health agencies to provide leadership in refuse-collection and disposal practice in the past may be due to several conditions. The public health agency is a regulatory type of department rarely given to operating functions. Refuse collection and disposal is definitely a public service or operating function, involving many employees, much equipment, and other problems not associated with community regulations. The job has therefore been usually assigned to a department in public works, sanitation, or a similar type of office. Frequently, refuse disposal has been a matter of private contract between the municipal governing body and a contractor. The public health agency should have a consulting position in these matters, but very often it does not. Lack of funds to employ qualified technical personnel and the higher priority of other activities are also reasons for past inactivity in this field on the part of many health departments.

In the last decade, however, most encouraging interest in the improvement of refuse disposal practices has developed on the part of public health and other groups. Studies in insect and rodent transmission of disease in recent years have pointed to insanitary practices of refuse storage, collection, and disposal as one of the principal

elements responsible for the production of these carriers of disease. The trichinosis studies concluded in 1944 by the National Institutes of Health demonstrated the role of raw-garbage feeding of hogs in the continued transmission of this disease.(2) From 4.5 to 5.0 per cent of garbage-fed swine were found to be infected with trichinae, as compared to 0.5 per cent of swine raised in fields or woods where they could not have ready access to kitchen garbage. In my opinion the development of the sanitary landfill method stimulated the interest of public health people more than any other development in this field, since it was an economical, sanitary method which was applicable to nearly every municipality. Prior to this development, the principal sanitary method of disposal was incineration, which is too expensive a proposition for some communities, especially those of 10,000 population or less.

Advantages of these Methods

Each of these methods, sanitary landfill and incineration, has a number of advantages which are enumerated below:

Sanitary Landfill	Incineration
Is economical.	Reduces decomposible organic material to ash.
Is flexible.	Eliminates fly and rat breeding.
Eliminates fly and rat breeding.	Eliminates long hauls.
Disposes of all types of refuse.	Can be located in or near built-up areas.
Is quickly organized and established.	Is a sanitary method.
Utilizes waste land.	
Renders waste land usable for certain purposes.	
Is a sanitary method.	

Shortcomings of these Methods

While each of these methods are sanitary when properly planned and operated, there are some possible shortcomings which need to be recognized in order that planning can guard against any adverse results. Comparative shortcomings that have been noticed in some cases or recognized as possible are listed below:

Sanitary Landfill

Improper construction may cause surface cracking, difficulty for travel of trucks on the surface in bad weather, and untidiness.
Salvage operations may be a nuisance.
Fills are generally unsuitable for heavy construction.
Seepage from fills into stream is high in B.O.D. and may accentuate stream pollution.
Excavations in old fill areas may be objectionable because of odors.
Explosive gases may seep into building basements in a fill.

Incineration

Costly to build and operate.
More inflexible to meet community growth.
Wastes only partially disposed of—dump is still necessary for ash and non-combustibles.
Auxiliary fill occasionally required.
More time needed to build before use is possible.
More personnel needed for operation.
Greater accident possibility.
Working conditions more disagreeable during hot weather.

Choosing a Method

When confronted with a choice of one of these two methods, the municipal officials must study certain basic questions and determine the answers peculiar to their problem and community before reaching a decision.

As mentioned earlier, sanitary landfill is less expensive in initial costs as well as operation, so that the availability of funds for either construction or operation may force the decision to that

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method. Available sites for either method must enter the considerations. It is possible that in a given case the only available landfill area is so far from town that hauling costs will make this method more expensive than incineration at a mid-town site. In considering either method, a long range view must be taken in regard to the site or sites available, the anticipated growth of the community, and the financial factors. In the consideration of landfill sites, one must be careful to recognize any possibility of stream or water-supply pollution from seepage water. Each community has local factors that need to be weighed in regard to the whole problem. It is therefore only possible to set forth a few of the general questions pertaining to the problem that require study.

Costs

Operating costs for sanitary landfills vary considerably, depending on hauling distances, method of operation, and management. In the type of operation usually considered typical, where haulage is to the outskirts of town, dirt for cover is obtained by trenching ahead of the fill; and under efficient management, the operating costs of the landfill should average about 50¢ per ton of refuse. One equipment manufacturer has developed a cost chart that sets up hypothetical five-year programs for cities of various population levels, from 5,000 to 300,000, and according to this chart one operator and one machine can handle the sanitary landfill for cities up to 40,000 population. (3)

The estimated amount of refuse for the average community of this population group in five years would be 80,000 tons. The landfill costs are estimated as follows for five years.

Equipment	$ 9,300.00
30 acres of land	4,000.00
1 operator	11,440.00
1 laborer	6,240.00
Maintenance and operation of equipment for five years	6,000.00
Total -	$ 36,980.00

On this estimate, the cost per ton for disposal is 46 cents. On smaller projects, such as those for cities of 10,000 population, the full time of equipment and operator is unnecessary for the landfill job, and it is important that they be used on other work of the community - on streets, in parks, etc. - so that full-time costs are not charged to the landfill. Any small community, through efficient use of equipment and operation, can thus insure economical operation of the fill.

Incinerator costs have increased substantially in the last few years. Construction costs which have been reported to us on a few plants indicate a range of $1,500 to $3,000 per ton of capacity, depending largely on the design and size. The larger plants which use storage hoppers and crane-charging equipment cost more per ton of capacity than the smaller incinerators where collection trucks dump directly on the charging floor. Operational costs, including amortization of the cost of construction, range from $1.50 to $2.50

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per ton of refuse incinerated. Several plants use a $2.00 per ton charge for private refuse, which is their cost of incineration.

However, one incinerator built recently, under a guarantee to the community by the engineer, is planned to incinerate 80 tons per day at a cost of 63¢ per ton, not including amortization. It is a 150-ton per day incinerator with an amortization cost of 34¢, on the 150-ton basis. At 80 tons per day, if the guarantee is met, the total cost will be $1.27 per ton incinerated. Another plant serving a community of 90,000 population with 150 tons per day capacity has thirteen employees operating the plant. There the incinerating cost, including amortization of the plant (built in 1946), is $2.00 per ton.

Current Trends in Refuse Disposal

Some of the current trends in refuse disposal are interesting. A survey in 1938 of disposal methods of 764 cities[4] is compared below with one made in 1947 for 302 cities[5], revealing the following use of various methods:

	1938	1947
Hog feeding	53%	41%
Dumping - all kinds	28%	37%
Incineration	28%	26%
Sanitary landfill	-	24.0%
Reduction	1.5%	1.0%
Dumping at sea, in lakes or rivers	1.0%	1.0%

Hog feeding appears to have decreased from 53% to 41% of the reporting cities. Dumping of all kinds has increased from 28% to 37%. Incineration has been relatively stable, along with reduction and dumping

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at sea or in rivers and lakes. Sanitary landfills were not generally used in 1938, only a few of them being in operation at that time. By 1947, we find 24% of the 302 reporting cities using this method of disposal. From manufacturers selling landfill equipment, we have learned that interest in sanitary landfills is very high and new cities are steadily being added to the list employing this method of disposal.

Summary

Last fall, Mr. J. C. Dawes of the British Ministry of Health, consultant to the World Health Organization and an expert on refuse disposal practices, made an extended trip in the United States and inspected many refuse disposal systems. His comment on this field of sanitation was, "Generally this foundational sanitary service is without adequate technical status and, consequently, is not regarded by the majority of municipal and county authorities as an essential public health service." On the present subject of discussion, Mr. Dawes writes: "The sanitary landfill is the cheapest of the approved methods of disposal when properly carried on, but it is a serious mistake to assume that it is 'a rule of thumb' process requiring little skill or knowledge successfully to operate; the contrary is the case. To insure success, technical direction is necessary. When local circumstances make the sanitary landfill method impracticable and a mechanical method necessary, direct incineration should be considered."(6)

Mr. William Foster, a fellow speaker on this panel, adequately summed up this subject in his article "Summarizing the Sanitary Landfill," which was published in The American City for April 1947.(7) He says: "Experience seems to indicate that the sanitary landfill finds particular favor in cities with an abundance of available land area which will not be needed for business or industrial purposes later. It is economically useful to the small city that is unable to build an incinerator, and it is a useful stopgap measure for larger cities that have not yet completed incinerator projects. If a large city has convenient areas where this filling operation can take place and has skilled personnel to operate it, it may very well find that the sanitary landfill is a permanent economical method of refuse disposal that meets exacting public health requirements."

We in the public health field can approve either sanitary landfill or incinerators. It has been pointed out that garbage from over 40% of the cities surveyed in 1947 was fed to hogs without cooking. Thus, while cities and States have taken elaborate precautions to protect people from many diseases formerly spread through water, milk, and food, many of these same cities and States are not only failing to provide safeguards against the spread of trichinosis infection but, by permitting the feeding of raw garbage to hogs, are actually contributing to the spread of the disease.

I can compliment you as State and local officials for the fine

progress that has been made in water, milk, and food sanitation, while closing with a plea that you also give some effort to promoting safer, healthier methods of refuse disposal.

References

(1) Wright, Willard H.; Jacobs, Leon; and Walton, Arthur C.: Studies on Trichinosis XVI. Epidemiological Considerations Based on the Examination for Trichinae of 5,313 Diaphragms from 189 Hospitals in 37 States and the District of Columbia. Public Health Report Reprint No. 2558 (May 26, 1944)

(2) Hall, Maurice C.: Studies on Trichinosis IV. The Role of the Garbage-Fed Hog in the Production of Human Trichinosis. Public Health Report, 52:27; 873-876 (July 2, 1937)

(3) What Does Your City Pay for Refuse Disposal: Booklet published by Drott Manufacturing Corporation, Milwaukee 8, Wisconsin.

(4) Wright, Willard H.: Studies on Trichinosis XIV. A Survey of Municipal Garbage Disposal Methods as Related to the Spread of Trichinosis. Public Health Report, 55:24, 1069-1077 (June 14, 1940)

(5) Refuse Disposal Practice and Cost: Engineering News-Record, 80-83 (May 13, 1948)

(6) Dawes, J. C.: The Storage, Collection and Disposal of Domestic Refuse (Including Garbage) in the U. S. A. World Health Organization Report dated January 19, 1950.

(7) Foster, William: Summarizing the Sanitary Landfill. The American City (April 1947)